FCC PART 15, SUBPART B AND C
TEST METHOD: ANSI C63.4-1992

for

REALPORT 2 BLUETOOTH ADAPTER
REALPORT BLUETOOTH 16 BIT
TYPE III PC CARD ADAPTER

Model: R2BT

Prepared for

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DATE: MARCH 7, 2001

	REPORT BODY	APPENDICES				TOTAL
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GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form unless done so in full with the written permission of Compatible Electronics.

This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Device Tested:	RealPort2 Bluetooth 16 Bit Type III PC Card Adapter Model: R2BT S/N: Pre-Production
Modifications:	The EUT was not modified in order to meet the specifications.
Manufacturer:	Xircom, Inc. 2300 Corporate Center Drive Thousand Oaks, California 91320
Test Dates:	March 5 and 6, 2001
File # For Canada	IC2154-D
Test Specifications:	EMI requirements Limits: EN 55022: 1998 Class B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247
Test Procedure:	ANSI C63.4: 1992
Test Deviations:	The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 450 kHz – 30 MHz	Complies with the **Class B** limits of EN 55022: 1998
2	Spurious Radiated RF Emissions, 30 MHz – 1000 MHz	Complies with the **Class B** limits of EN 55022: 1998
3	Spurious Radiated RF Emissions, 10 kHz – 30 MHz and 1000 MHz – 25000 MHz	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247(c)
4	Fundamental and Emissions produced by the intentional radiator in non-restricted bands, 10 kHz – 25 GHz	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247(c)
5	Emissions produced by the intentional radiator in restricted bands, 10 kHz – 25 GHz	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.205, 15.209(a), and section 15.247 (c)
6	20 dB Bandwidth	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(1)(ii)
7	Peak Power Output	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b)(1)
8	Channel Hopping Separation	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(1) and 15.247 (a)(1)(ii)
9	Average Time of Occupancy	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(1)(ii)

1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the RealPort2 Bluetooth 16 Bit Type III PC Card Adapter Model: R2BT. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 1992. The tests were performed in order to determine whether the electromagnetic emissions from the RealPort2 Bluetooth 16 Bit Type III PC Card Adapter, referred to as EUT hereafter, are within the specification limits defined by FCC Title 47, Part 15, Subpart C, sections 15.207, 15.209 and 15.247.

Note: For the unintentional radiator portion of the test, the EUT was within the **Class B** specification limits defined by C.I.S.P.R. Publication 22 for Information Technology Equipment. Under paragraph E of section 15.107 and paragraph G of section 15.109 of the Code of Federal Regulations Title 47, Part 15 of the FCC rules, FCC accepts the international standards set forth in C.I.S.P.R. Publication 22.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

Xircom, Inc.

James K. Baer	Manager Global Compliance Engineer
Robert W. Paxman	Compliance Engineer
J. Ricardo Campos	Compliance Engineer

Compatible Electronics Inc.

Kyle Fujimoto	Test Engineer
Scott McCutchan	Lab Manager

2.4 Date Test Sample was Received

The test sample was received on March 5, 2001

2.5 Disposition of the Test Sample

The test sample was returned to Xircom, Inc. on February 12, 2001.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
FCC Title 47, Part 15 Subpart C	FCC Rules - Radio frequency devices (including digital devices) – Intentional Radiators.
ANSI C63.4 1992	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.
FCC Title 47, Part 15 Subpart B	FCC Rules - Radio frequency devices (including digital devices) – Unintentional Radiators.

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration - EMI

Specifics of the EUT and Peripherals Tested

The RealPort2 Bluetooth 16 Bit Type III PC Card Adapter Model: R2BT (EUT) was installed inside the PCMCIA port of the host laptop. The low, middle, and high channels were tested. The host laptop was also connected to the printer, modem, and AC Adapter via its parallel, serial, and power ports, respectively. The accessory laptop was connected to an AC Adapter via its power port. The accessory laptop and its AC Adapter were placed approximately 5 meters away from the test site (inside the building). The radiated as well as conducted data was taken in the modes described below. All initial investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix C. The data sheets are located in Appendix D.

Operation of the EUT during the testing

For the intentional radiator portion of the test - The EUT used a program called Bluetooth to lock one channel at a time so that the low, middle, and high channels could be tested.

For the unintentional radiator portion of the test - The EUT used its default wireless program called Blueview. The EUT was connected to the accessory Bluetooth device by a "virtual com port" (COM 12 through COM 19) RF wireless connection. Once the connection was established, Hyperterminal was used to TX/RX data in a continuous mode (Maximum Speed).

4.1.1 Cable Construction and Termination

Cable 1 This is a 5 foot braid and foil shielded cable connecting the printer to the host laptop. It has a Centronics metallic type connector at the printer end and a D-25 pin metallic connector at the host laptop end. The cable was bundled to a length of 1 meter. The shield of the cable was grounded to the chassis via the connectors.

Cable 2 This is a 6 foot unshielded cable connecting the host laptop to the AC Adapter. It has a 1/8 inch power connector at the host laptop end and is hard wired into the AC Adapter. The cable was bundled to a length of 1 meter.

Cable 3 This is a 5 foot braid and foil shielded cable connecting the host laptop to the modem. It has a D-9 pin metallic connector at the host laptop end and a D-25 pin metallic connector at the modem end. The cable was bundled to a length of 1 meter. The shield of the cable was grounded to the chassis via the connectors.

Cable 4 This is a 6 foot unshielded cable connecting the accessory laptop to the AC Adapter. It has a 1/8 inch power connector at the accessory laptop end and is hard wired into the AC Adapter. The cable was bundled to a length of 1 meter.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
REALPORT2 BLUETOOTH 16 BIT TYPE III PC CARD ADAPTER (EUT)	XIRCOM, INC.	R2BT	N/A	J3OR2BT001
PRINTER	CITIZEN	LSP-10	1262247-73	DLK66TLSP-10
MODEM	HAYES	231AA	A07031003480	BFJ9D9231AA
HOST LAPTOP	IBM	TYPE 2626	AF-1K507	DoC
AC ADAPTER FOR HOST LAPTOP	IBM	P/N: 02K6549	N/A	N/A
ACCESSORY LAPTOP	DELL	PPM	P/N: 0027U Rev. A00	DoC
AC ADAPTER FOR ACCESSORY LAPTOP	DELL	ADP-70EB	1791-029-2K4X	N/A
REALPORT2 BLUETOOTH 16 BIT TYPE III PC CARD ADAPTER (ACCESSORY)	XIRCOM, INC.	R2BT	N/A	J3OR2BT001

5.2 EMI Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Spectrum Analyzer	Hewlett Packard	8566B	3701A22262	June 24, 2000	June 24, 2001
Preamplifier	Com Power	PA-102	1017	Jan. 5, 2001	Jan. 5, 2002
Quasi-Peak Adapter	Hewlett Packard	85650A	2811A01363	June 24, 2000	June 24, 2001
Biconical Antenna	Com Power	AB-100	1548	Oct. 16, 2000	Oct. 16, 2001
Log Periodic Antenna	Com Power	AL-100	16039	Oct. 16, 2000	Oct. 16, 2001
Antenna Mast	Com Power	AM-100	N/A	N/A	N/A
Turntable	Com Power	TT-100	N/A	N/A	N/A
Computer	Hewlett Packard	D5251A 888	US74458128	N/A	N/A
Printer	Hewlett Packard	C5886A	SG7CM1P090	N/A	N/A
Monitor	Hewlett Packard	D5258A	DK74889705	N/A	N/A
Loop Antenna	Com-Power	AL-130	25309	May 25, 2000	May 25, 2001
Horn Antenna	Antenna Research	DRG-118/A	1053	Jan. 15, 2001	Jan. 15, 2002
Horn Antenna	Antenna Research	MWH-1826/B	1004	Jan. 21, 1997	N.C.R.
Microwave Preamplifier	Com-Power	PA-122	25195	Jan. 9, 2001	Jan. 9, 2002
Amplifier	Hewlett Packard	11975A	2403A00202	Feb. 5, 2001	Feb. 5, 2002
Harmonic Mixer	Hewlett Packard	11970K	3003A05460	Feb. 17, 2001	Feb. 17, 2002

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 8.1.2 of this report for EMI test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was installed inside the PCMCIA slot of the laptop. The laptop was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was grounded to the laptop via its connection pins.

7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Transmitter Power

Transmit power is herein defined as the power delivered to a 50 Ohm load at the proprietary antenna connector on the RadioWire unit.

Power	Channel	Accuracy
-0.10 dBm	LOW	+1/-1 dB
-5.20 dBm	MIDDLE	+1/-1 dB
-7.50 dBm	HIGH	+1/-1 dB

7.2 Channel Number and Frequencies

There are a total of 79 channels. The low channel is at 2402.0 MHz and the high channel is at 2480.0 MHz. There is a 1 MHz separation between channels.

Channel 1: 2402 MHz
Channel 2: 2403 MHz
(Etc.)

7.3 Antenna Gain

0 dBi peak

7.4 Description of Transmitter

This transmitter design consists of a Cambridge Silicon Radio (CSR) BC01B Bluetooth Chipset and a ZiLog Z86017 general purpose PCMCIA Controller. The Modulation Scheme is Frequency Hopping Spread Spectrum (FHSS). This transmitter has a Hybrid Mode (Data Mode + Acquisition Mode) has part of its Bluetooth design via the Universal Asynchronous Receiver/Transmitter (UART).

8. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

8.1 RF Emissions

8.1.1 Conducted Emissions Test

The spectrum analyzer was used as a measuring meter. The data was collected with the spectrum analyzer in the peak detect mode with the "Max Hold" feature activated. The quasi-peak was used only where indicated in the data sheets. A 10 dB attenuation pad was used for the protection of the spectrum analyzer input stage, and the offset was adjusted accordingly to read the actual data measured. The LISN output was measured using the spectrum analyzer. The output of the second LISN was terminated by a 50 ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI C63.4: 1992. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by the Compatible Electronics conducted emissions software in several overlapping sweeps by running the spectrum analyzer at a minimum scan rate of 10 seconds per octave. The final qualification data is located in Appendix E.

Test Results:

The EUT complies with the **Class B** limits of EN 55022: 1998 for conducted emissions.

8.1.2 Radiated Emissions (Spurious and Harmonics) Test

The spectrum analyzer was used as a measuring meter along with the quasi-peak adapter. Amplifiers were used to increase the sensitivity of the instrument. The Com Power Preamplifier Model: PA-102 was used for frequencies from 30 MHz to 1 GHz, and the Com-Power Microwave Preamplifier Model: PA-122 was used for frequencies above 1 GHz. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps. The quasi-peak adapter was used only for those readings which are marked accordingly on the data sheets. The frequencies above 1 GHz were averaged manually by narrowing the video filter down to 10 Hz and putting the sweep time on AUTO on the spectrum analyzer to keep the amplitude reading calibrated. The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
10 kHz to 150 kHz	200 Hz	Active Loop Antenna
150 kHz to 30 MHz	9 kHz	Active Loop Antenna
30 MHz to 300 MHz	120 kHz	Biconical Antenna
300 MHz to 1 GHz	120 kHz	Log Periodic Antenna
1 GHz to 25 GHz	1 MHz	Horn Antenna

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 1992. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

Radiated Emissions (Spurious and Harmonics) Test (con't)

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance from 10 kHz to 30 MHz and from 1 GHz to 25 GHz to obtain final test data. From 30 MHz to 1000 MHz, the EUT was tested at a 10 meter test distance.

For the 22 GHz – 25 GHz span, the Hewlett Packard 11970K Harmonic Mixer and the Hewlett Packard 11975A Amplifier were used to allow the spectrum analyzer to scan up to 25 GHz.

8.2 20 dB Bandwidth

The 20 dB Bandwidth was taken using the spectrum analyzer. The bandwidth was measured using a direct connection from the RF out on the RF board. The resolution bandwidth was 100 kHz, and the video bandwidth 100 kHz.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1)(ii). The bandwidth is less than 1 MHz. Please see the data sheets located in Appendix D.

8.3 Peak Output Power

The Peak Output Power was taken using the spectrum analyzer. The bandwidth was measured using a direct connection from the RF out on the RF board. The resolution bandwidth was 1 MHz, and the video bandwidth was 1 MHz.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (b)(1). The maximum peak output power is less than 1 watt.

8.4 RF Antenna Conducted Test

The RF antenna conducted test was taken using the spectrum analyzer. The RF antenna conducted test was measured using a direct connection from the RF out on the RF board into the input of the analyzer. The resolution bandwidth was 100 kHz, and the video bandwidth 300 kHz. The spans were wide enough to include all the harmonics and emissions that were produced by the intentional radiator.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (c). The RF power that is produced by the intentional radiator is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power.

8.5 RF Band Edges

The RF band edges were taken at the edges of the ISM spectrum (2390 MHz when the EUT was on the low channel and 2483.5 MHz when the EUT was on the high channel) using the spectrum analyzer. It was also verified that the transmitted signals did not appear in the restricted bands below 2390 MHz and above 2843.5 MHz. A spectral plot of the band edges are included to prove no emissions were found at these frequencies. A preamplifier was used to boost the signal level, with the plots being taken at 3 meter test distance.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (c). The RF power at the band edges at 2390 MHz and 2483.5 MHz meet the limits of section 15.209.

8.6 Carrier Frequency Separation

The Channel Hopping Separation Test was taken using the spectrum analyzer. The EUT was operating in its normal operating mode. The resolution bandwidth was 100 kHz, and the video bandwidth 100 kHz. The frequency span was wide enough to include the peaks of two adjacent channels.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1) and 15.247 (a)(1)(ii). The Channel Hopping Separation is greater than the 20 dB bandwidth.

8.7 Number of Hopping Frequencies

The Channel Hopping Separation Test was taken using the spectrum analyzer. The EUT was operating in its normal operating mode. The resolution bandwidth was 1 MHz, and the video bandwidth 1 MHz. The frequency span was wide enough to include all of the peaks in the frequency band of operation.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1) and 15.247 (a)(1)(ii). The number of hopping frequencies is 79.

8.8 Average Time of Occupancy Test

The Average Time of Occupancy Test was taken using the spectrum analyzer. The EUT was operating in normal operating mode. The frequency span was taken to 0 Hz with a sweep time of 20 msec to determine the time for each transmission. Once the time for each transmission was determined, the sweep time was changed to 400 msec with the EUT operating for a 30 seconds to determine if the EUT transmitted for more than 400 msec during a 30 second period on any frequency.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1)(ii). The EUT does not transmit for more than 400 msec during a 30 second period on any frequency.

9. CONCLUSIONS

The RealPort2 Bluetooth 16 Bit Type III PC Card Adapter Model: R2BT meets all of the specification limits defined in FCC Title 47, Part 15, Subpart C, sections 15.205, 15.207, 15.209, and 15.247.

Note: For the unintentional radiator portion of the test, the EUT was within the **Class B** specification limits defined by C.I.S.P.R. Publication 22 for Information Technology Equipment. Under paragraph E of section 15.107 and paragraph G of section 15.109 of the Code of Federal Regulations Title 47, Part 15 of the FCC rules, FCC accepts the international standards set forth in C.I.S.P.R. Publication 22.

APPENDIX A

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC Subpart B specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

Modifications:

No Modifications were made to the EUT during the testing.

APPENDIX B

ADDITIONAL MODELS COVERED UNDER THIS REPORT

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	RealPort2 Bluetooth 16 Bit Type III PC Card Adapter Model: R2BT S/N: N/A

There were no additional models covered under this report.

APPENDIX C

DIAGRAMS, CHARTS AND PHOTOS

FIGURE 1: CONDUCTED EMISSIONS TEST SETUP

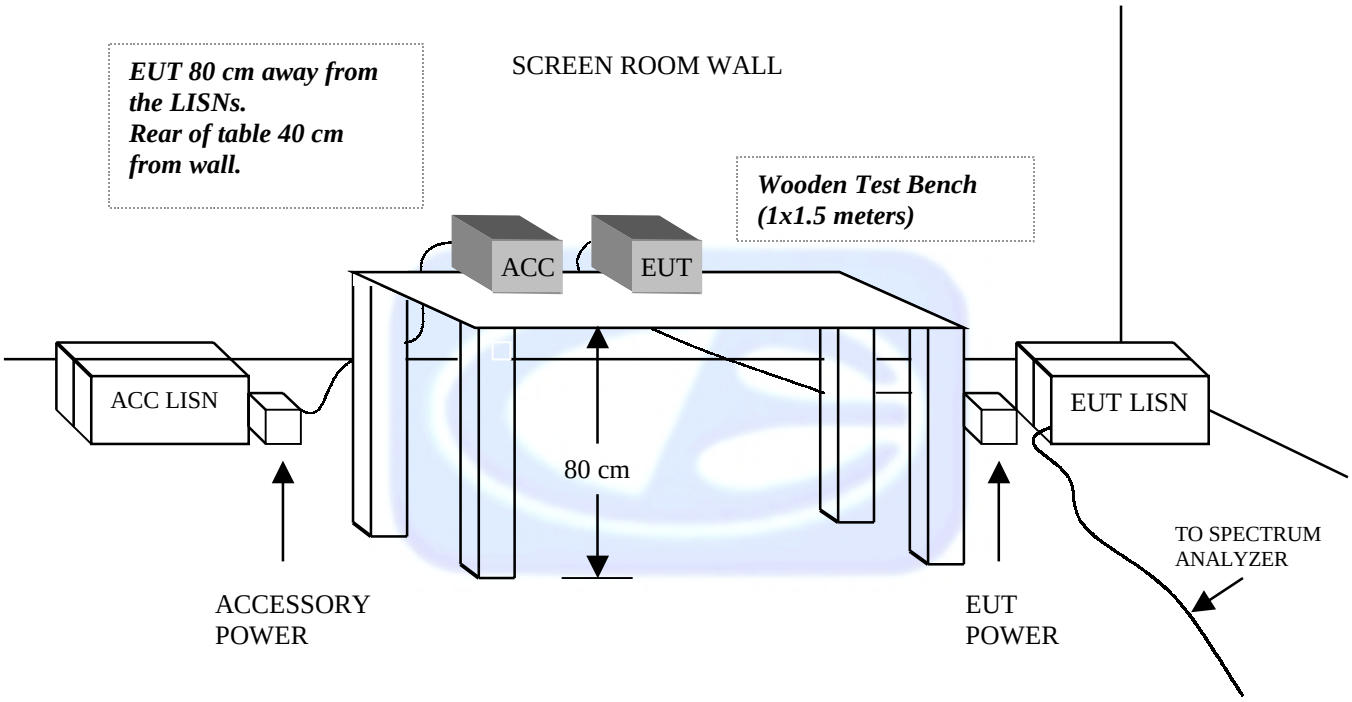
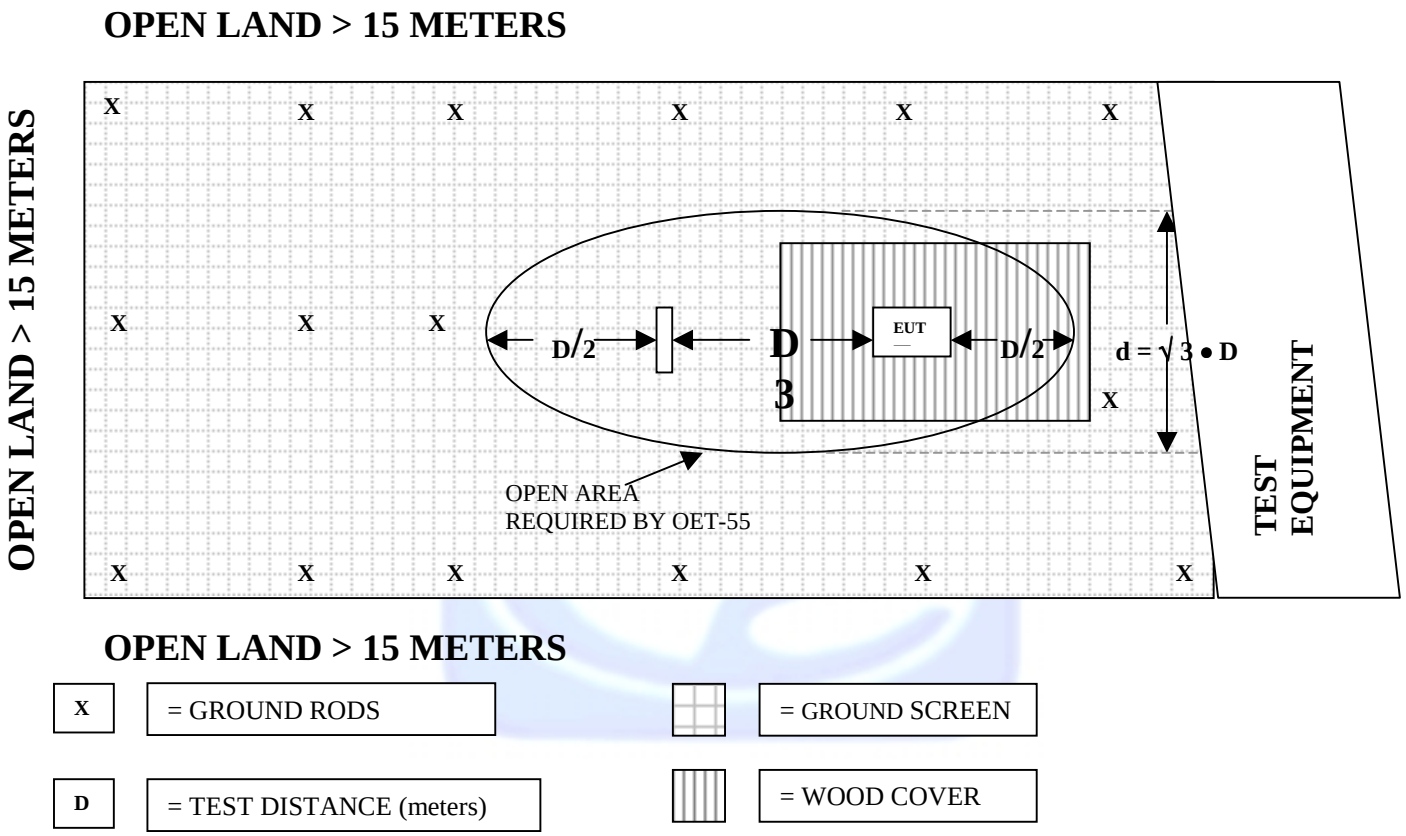


FIGURE 2: PLOT MAP AND LAYOUT OF RADIATED SITE



FRONT VIEW

XIRCOM, INC.
REALPORT2 BLUETOOTH 16 BIT TYPE III PC CARD ADAPTER
Model: R2BT
FCC SUBPART C - RADIATED EMISSIONS – 3-5-01

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

XIRCOM, INC.
REALPORT2 BLUETOOTH 16 BIT TYPE III PC CARD ADAPTER
Model: R2BT
FCC SUBPART C - RADIATED EMISSIONS – 3-5-01

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

FRONT VIEW

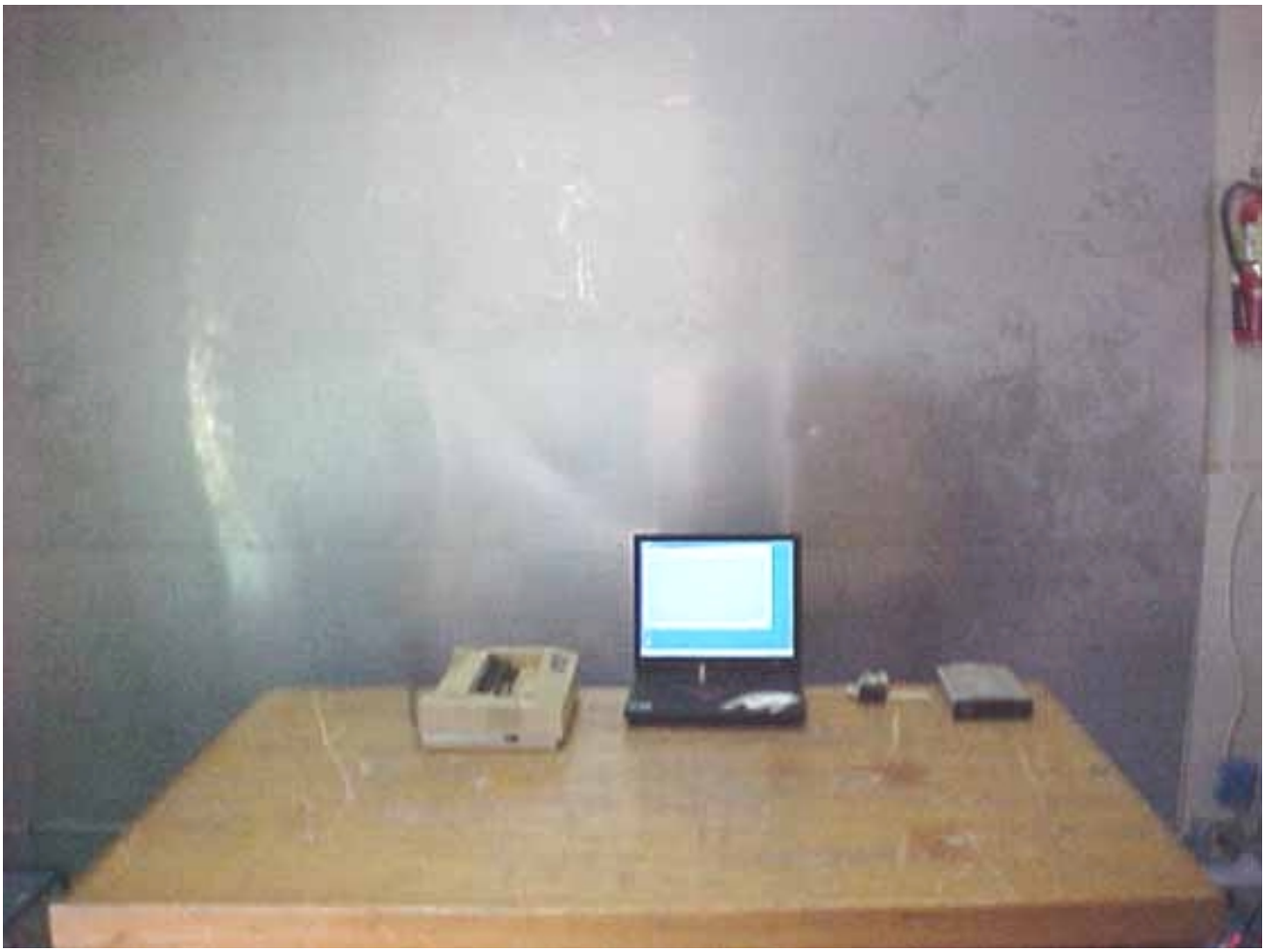
XIRCOM, INC.
REALPORT2 BLUETOOTH 16 BIT TYPE III PC CARD ADAPTER
Model: R2BT
EN 55022 CLASS B - RADIATED EMISSIONS – 3-5-01

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

XIRCOM, INC.
REALPORT2 BLUETOOTH 16 BIT TYPE III PC CARD ADAPTER
Model: R2BT
EN 55022 CLASS B - RADIATED EMISSIONS – 3-5-01

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

XIRCOM, INC.
REALPORT2 BLUETOOTH 16 BIT TYPE III PC CARD ADAPTER
Model: R2BT
FCC SUBPART C - CONDUCTED EMISSIONS – 3-6-01

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

XIRCOM, INC.
REALPORT2 BLUETOOTH 16 BIT TYPE III PC CARD ADAPTER
Model: R2BT
FCC SUBPART C - CONDUCTED EMISSIONS – 3-6-01

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

COM-POWER AB-100

BICONICAL ANTENNA

S/N: 01548

CALIBRATION DATE: OCTOBER 16, 2000

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	14.01	120	10.33
35	13.63	125	11.61
40	13.26	140	12.70
45	11.62	150	12.95
50	11.03	160	13.58
60	8.52	175	14.82
70	8.94	180	14.84
80	8.17	200	14.80
90	8.08	250	16.42
100	8.64	300	20.26

COM-POWER AL-100

LOG PERIODIC ANTENNA

S/N: 16101

CALIBRATION DATE: OCTOBER 16, 2000

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
300	12.96	700	19.24
400	16.92	800	21.37
500	16.73	900	22.13
600	16.32	1000	22.19

COM-POWER PA-102

PREAMPLIFIER

S/N: 1017

CALIBRATION DATE: JANUARY 5, 2001

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	39.0	300	38.9
40	39.2	350	38.9
50	39.2	400	38.6
60	39.2	450	38.5
70	38.8	500	38.7
80	38.6	550	38.4
90	38.5	600	38.8
100	38.7	650	38.5
125	39.2	700	38.6
150	38.8	750	38.1
175	38.8	800	37.9
200	39.0	850	38.0
225	38.8	900	37.8
250	38.8	950	36.9
275	39.0	1000	38.2

COM-POWER PA-122

MICROWAVE PREAMPLIFIER

S/N: 25195

CALIBRATION DATE: JANUARY 9, 2001

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	33.1	9.5	30.7
1.1	33.0	10.0	31.6
1.2	33.2	11.0	30.6
1.3	33.0	12.0	28.5
1.4	32.4	13.0	31.5
1.5	32.3	14.0	33.2
1.6	32.1	15.0	31.5
1.7	32.0	16.0	30.2
1.8	31.8	17.0	31.6
1.9	32.2	18.0	31.7
2.0	32.6		
2.5	31.9		
3.0	31.7		
3.5	31.7		
4.0	32.3		
4.5	31.5		
5.0	32.3		
5.5	34.2		
6.0	30.9		
6.5	32.0		
7.0	32.1		
7.5	33.0		
8.0	31.9		
8.5	31.9		
9.0	31.3		

ANTENNA RESEARCH DRG-118/A

HORN ANTENNA

S/N: 1053

CALIBRATION DATE: JANUARY 15, 2001

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	25.4	9.5	39.6
1.5	26.7	10.0	39.7
2.0	29.6	10.5	40.8
2.5	30.7	11.0	40.4
3.0	31.2	11.5	42.2
3.5	32.3	12.0	43.0
4.0	33.2	12.5	42.6
4.5	33.2	13.0	41.3
5.0	34.8	13.5	40.3
5.5	35.4	14.0	40.9
6.0	36.6	14.5	44.0
6.5	36.6	15.0	43.3
7.0	38.7	15.5	42.7
7.5	38.6	16.0	42.6
8.0	37.9	16.5	42.8
8.5	37.9	17.0	43.5
9.0	39.9	17.5	44.6
		18.0	42.2

ANTENNA RESEARCH
11317 Frederick Avenue, Beltsville, MD 20705, USA
TEL: (301)937-8888 FAX: (301)937-2796

E-FIELD ANTENNA FACTOR CALIBRATION

E (dB V/m) = V_o (dB V) + AFE (dB 1/m)

Model Number : MWH-1826/B

Frequency (GHz)	AFE (dB 1/m)	Gain (dBi)
18.000	23.1	32.2
18.850	23.2	32.5
19.700	23.6	32.5
20.550	23.5	33.0
21.400	23.7	33.1
22.250	24.0	33.2
23.100	24.0	33.5
23.950	24.1	33.7
24.800	24.1	34.0
25.650	24.3	34.1
26.500	24.4	34.3

Serial Number : 1004

Com-Power Corporation

(949) 587-9800

Antenna Calibration

Antenna Type:	Loop Antenna
Model:	AL-130
Serial Number:	25309
Calibration Date:	05/25/00

Frequency MHz	Magnetic (dB/m)	Electric dB/m
0.009	-41.0	10.5
0.01	-41.0	10.5
0.02	-41.9	9.6
0.05	-41.9	9.6
0.075	-41.8	9.7
0.1	-42.2	9.3
0.15	-42.2	9.3
0.25	-40.7	10.8
0.5	-42.1	9.4
0.75	-40.9	10.6
1	-41.3	10.2
2	-40.8	10.7
3	-41.1	10.4
4	-41.2	10.3
5	-40.7	10.8
10	-40.6	10.9
15	-42.0	9.5
20	-42.0	9.5
25	-42.9	8.6
30	-42.3	9.2

Trans. Antenna Height	2 meter
Receiving Antenna Height	2 meter